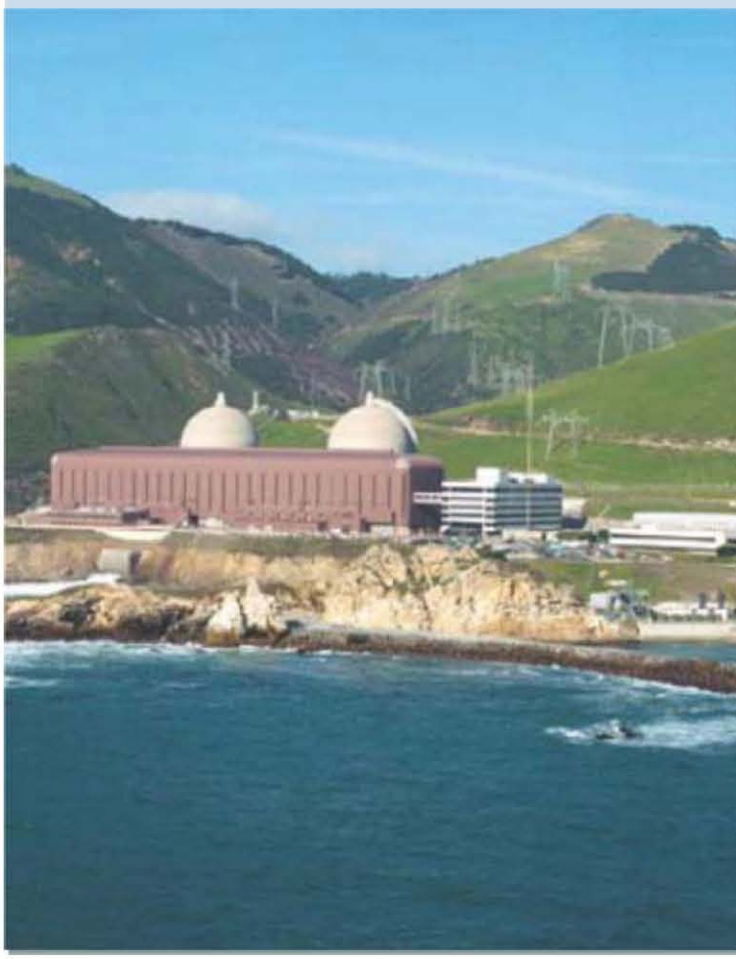
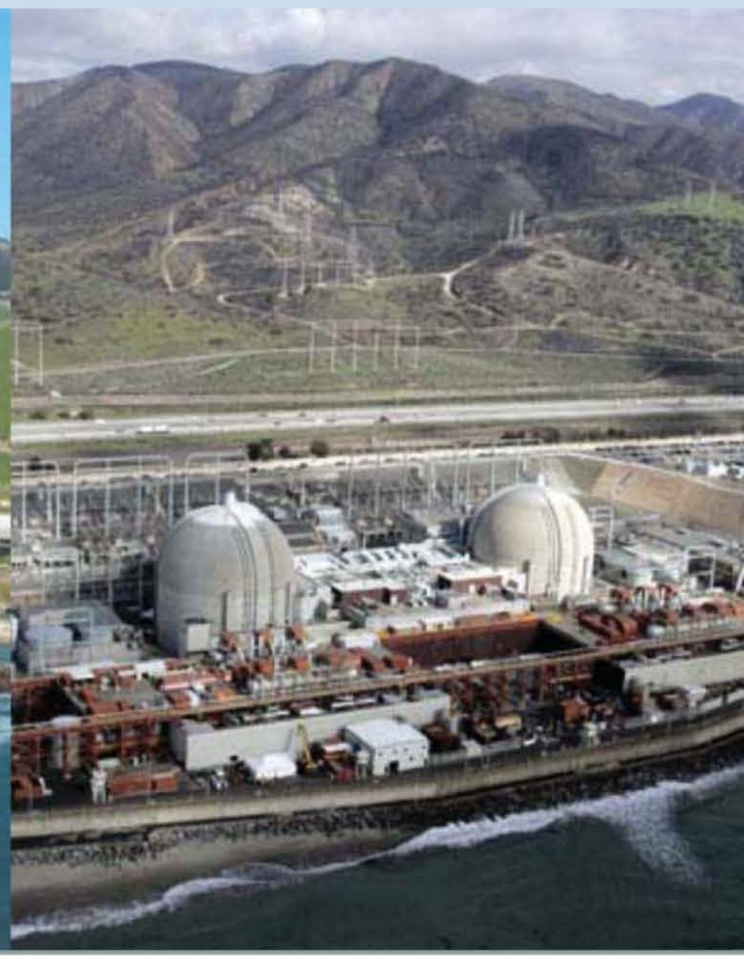
CIVIL
GOVERNMENT SERVICES
MINING & METALS
OIL, GAS & CHEMICALS
POWER

JUOTC Project for PG&E and SCE

First Draft
Comprehensive Consultant
ITP Technologies Assessment
Report to Review Committee
March 2013





ENGINEERING

The Review Committee (RC) has reviewed Bechtel's Phase I interim reports and, based on Bechtel's assessments (Criteria 1 through 9) of the feasibility of the various technologies, approved further assessments (Criteria 10 and 11) of the following three technologies at each site (DCPP and SONGS):

1. Closed-Cycle Cooling Systems – five cooling variations, including hybrids (Closed-Cycle Cooling)
2. Inshore mechanical (active) intake fine mesh screening system (Inshore Fine Mesh Screening)
3. Offshore modular wedge wire or similar exclusion screening system (Offshore Wedge Wire Screening)

Criterion 10, Nuclear Specific Assessment, will be evaluated for each of the above technologies. Criterion 11, Detailed Cost and Schedule, will be undertaken for each of the above technologies that are determined to pass Criterion 10 evaluation.

This interim report is intended to provide preliminary in-process design drawings that document our current design approach. These documents should not be considered final at this stage because they may change as more design information becomes available, particularly from equipment vendors and construction subcontractors.

Please refer to the attached level 1 project schedule, which presents the schedule showing the completed and ongoing work to support the issuance of the final report to the Nuclear Review Committee scheduled for October 1, 2013.

The designs for each site and technology are briefly described below. These descriptions are not complete system descriptions but give the reader an overview of each design as an aid to understanding the system drawings provided. Each description refers to drawings associated with the technology that are included in the report.

For equipment and specialized construction activities that are potentially high in cost, Bechtel normally obtains industry pricing to support our Estimating Department efforts. Bechtel develops mini-specifications describing the equipment/construction requirements and issues these material requisitions (MRs) and service requisitions (SRs) to the industry for indicative pricing and supporting technical information. We always attempt to get several bidders for each commodity, although this is not always possible. This vendor information is then used for the design and estimating efforts. The status of these efforts to date is as follows:

Bids Received

- Cooling Towers for Dry Natural and Dry Mechanical Technologies
- Desalination System
- Reclaim Water Treatment System

- Heat Exchangers

<u>Out for Bid</u>

- Cooling Towers for Dry Natural and Dry Mechanical Technologies – additional bidders
- Cooling Towers for Wet Natural, Wet Mechanical, and Hybrid Technologies
- Desalination System – additional bidders
- Reclaim Water Treatment System – additional bidders
- Fine Mesh Screens

<u>MR/SR Documents to be Issued</u>

- Butterfly Valves
- Large Vertical Pumps
- Condenser Upgrades
- Low Pressure Turbine Upgrade
- Under-Highway Tunnel
- Cooling Water Piping
- Marine Package for SONGS Fine Mesh Screen House
- Marine Package for Wedge Wire Technologies
- Electrical Transformers

TECHNOLOGY OVERSIGHTS—DCPP

This section provides a summary description of progress on technology concepts being pursued in Phase 2 of the State OTC-Policy Nuclear Fueled Power Plant (NFPP) Special Studies for DCPP. Intent of Phase 2 of the Special Studies is inform the SCRCB on plant specific feasibility/efficacy of the technologies under evaluation to reduced impingement and entrainment associated with operation of existing plant once-through cooling systems. The Phase 2 technologies described are:

- Closed Cycle Cooling Water Systems (Cooling Towers); five different types of cooling towers were considered:
    - Dry Natural Draft Cooling Tower
    - Dry Mechanical Draft Cooling Tower
    - Wet Natural Draft Cooling Tower
    - Wet Mechanical Draft Cooling Tower
    - Hybrid Cooling Tower (combination of the dry and wet technologies)
- Inshore Mechanical (Active) Intake Fine Mesh Screening Systems (Inshore Fine Mesh Screening)

- Offshore modular wedge wire or similar exclusion screening system (Offshore Wedge Wire Screening)

<u>Closed Cycle Cooling Systems</u>

The options considered replace only the non-safety related portions of the existing once-through cooling system. The portion of the existing system identified as "auxiliary saltwater cooling" remains a once-through cooling system. The general locations of the cooling towers and primary circulating piping are essentially identical for all of these closed cycle cooling systems. The primary differences are related to the specific tower designs and the required supporting systems.

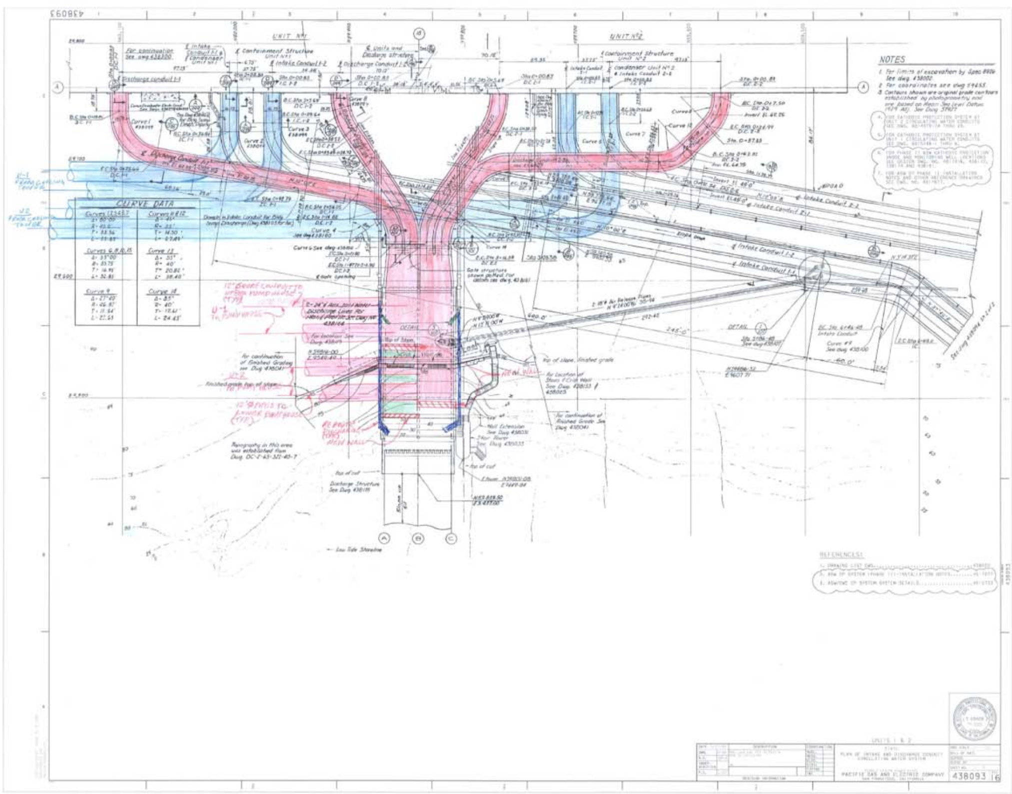
Dry Natural Draft Cooling Tower

Reference Drawings:

- 25762-110-E1K-0000-00001 One Line Diagram: DCPP Circulating Water System Natural Draft Cooling (Dry)
- 25762-110-M5K-WL-00001 PFD Circulating Water System – Natural Draft Cooling (Dry)
- 25762-110-M5K-YA-00001/1 Water Balance Diagram
- 25762-110-M5K-YA-00001/2 Water Balance Diagram
- 25762-110-M6K-WL-00001 P&ID Circulating Water System Natural Draft Cooling (Dry)
- 25762-110-P1K-WL-00010 Circulating Water System – Dry Natural Draft Cooling Tower – General Arrangement

Cooling towers for Unit 1 and Unit 2 will be located northeast of the Unit 1 turbine building and east of the existing SLO-2 Archeological Site. The existing portion of the mountain at this location will be lowered to an elevation of 115 feet to accommodate the towers. Three metal hyperbolic natural draft towers will be required to support each unit, resulting in a total of six towers. The towers will be capable of maintaining a design "cold" circulating water temperature of 103°F, which is significantly higher than the once-through system "cold" temperature of 65°F. The increase in cold water temperature will result in higher condenser backpressures, which will result in a net decrease in power. In addition, a water temperature of 103°F is too high to support the equipment supported by the service water heat exchangers and component cooler. These components will be placed on an independent once-through cooling system requiring a flow of approximately 5,900 gpm per unit to be withdrawn from the existing seawater intake structure.

Two circulating water pumphouse structures will be provided, one for each unit. The Unit 1 pumphouse will be located northeast of the turbine building and south of the SLO-2 Archeological Site. The Unit 2 pumphouse will be located west of the Unit 1 turbine building. Two 12-foot-in-diameter supply pipes per unit will be routed from the cooling tower structures to the west side of the turbine building. The existing condenser inlet concrete conduits will be modified to connect to these pipes. The condenser outlet concrete conduit will be modified, Gates 1A and 2A will be removed, and the conduit will be isolated from the plant outfall. Two 12-foot-in-diameter pipes per unit will be connected to the modified condenser outlet concrete conduit and routed to the associated unit's circulating water pumphouse structure. The following figures illustrate how the piping to and from the condenser will be connected to the new circulating water system piping. This figure applies to all of the closed cooling water options on DCPP. Four 25%-capacity circulating water pumps with common suction and discharge headers will be provided per unit. From each unit's pumphouse, two 12-foot-in-diameter pipes will be routed back to the cooling tower inlets.



The closed cycle cooling system requires an increase in the overall design pressure of the circulating water system. The tube side of the main condensers will be modified to increase the tube-side pressure design from 25 psig to 50 psig.

Because the dry system does not evaporate water, makeup is only required to fill the system and make up for leakage. The existing plant water supply system(s) will be used to supply the necessary makeup.

The existing circulating water pump motors and pump internals (two per unit) will be removed from the existing shoreline intake structure, and modifications will be made to accommodate two new saltwater cooling pumps per unit. The saltwater cooling pumps will be used to provide the necessary cooling water to the service water heat exchangers and component coolers.

Access/maintenance roads will be provided. The existing fire loop will be extended to the cooling tower area.

The electrical load for this option is currently estimated to be 30 MVA per unit. Due to the sizes and locations of the electrical loads, a dedicated new power distribution system taken from the high voltage switchyard is required. The design basis will be to have two 100%-capacity power supplies feed these loads. Two three-winding, 30 MVA transformers will feed each unit. The four circulating water pumps will be fed from each of the secondary windings. The “new” electrical distribution voltage levels will be 12 kV (in line with the existing MV at DCPP) for the large circulating water motors (11.5 kV), 480 V for the cooling tower auxiliary equipment, and 120 V AC for smaller loads. There will be dedicated 125 V DC batteries (along with an associated battery charger) for critical UPS loads and control power for distribution equipment. The batteries will be sized for a 2-hour duration, and the charger will be sized to recharge them in 8 hours.

New loads located in the existing plant intake area (e.g., the saltwater supply pumps, two per unit) will be fed from the existing power distribution system. The existing power capacity will have adequate spare capacity because the existing feed to the circulating water pumps (two at 13,000 hp per unit) will be removed since the new cooling water pumps will be fed from the new distribution system.

Dry Mechanical Draft Cooling Tower

Reference Drawings:

- 25762-110-E1K-0000-00002 — One Line Diagram: DCPP Circulating Water System Mechanical Draft Cooling (Dry)
- 25762-110-M5K-WL-00002 — PFD Circulating Water System – Mechanical Draft Cooling (Dry)
- 25762-110-M5K-YA-00001/1 — Water Balance Diagram
- 25762-110-M5K-YA-00001/2 — Water Balance Diagram
- 25762-110-M6K-WL-00002 — P&ID Circulating Water System – Mechanical Draft Cooling (Dry)
- 25762-110-P1K-WL-00020 — Circulating Water System – Dry Mechanical Draft Cooling Tower – General Arrangement

Cooling towers for Unit 1 and Unit 2 will be located northeast of the Unit 1 turbine building and east of the existing SLO-2 Archeological Site. The existing portion of the mountain at this location will be lowered to an elevation of 115 feet to accommodate the towers. One concrete/fiberglass rectangular mechanical draft tower (approximately 760 feet x 1,590 feet) will be required to support each unit. The towers will be capable of maintaining a design “cold” circulating water temperature of 103°F, which is significantly higher than the once-through system “cold” temperature of 65°F. The increase in cold water temperature will result in higher condenser backpressures, which will result in a net decrease in power. In addition, a water temperature of 103°F is too high to support the equipment supported by the service water heat exchangers and component cooler. These components will be placed on an independent once-through cooling system requiring a flow of approximately 5,900 gpm per unit to be withdrawn from the existing seawater intake structure.

Two circulating water pumphouse structures will be provided, one for each unit. The Unit 1 pumphouse will be located northeast of the turbine building and south of the SLO-2 Archeological Site. The Unit 2 pumphouse will be located west of the Unit 1 turbine building. Two 12-foot-in-diameter supply pipes per unit will be routed from the cooling tower structures to the west side of the turbine building. The existing condenser inlet concrete conduits will be modified to connect to these pipes. The condenser outlet concrete conduit will be modified, Gates 1A and 2A will be removed, and the conduit will be isolated from the plant outfall. Two 12-foot-in-diameter pipes per unit will be connected to the modified condenser outlet concrete conduit and routed to the associated unit's circulating water pumphouse structure. Four 25%-capacity circulating water pumps with common suction and discharge headers will be provided per unit. From each unit's pumphouse, two 12-foot-in-diameter pipes will be routed back to the cooling tower inlets.

The closed cycle cooling system requires an increase in the overall design pressure of the circulating water system. The tube side of the main condensers will be modified to increase the tube-side pressure design from 25 psig to 50 psig.

Because the dry system does not evaporate water, makeup is only required to fill the system and make up for leakage. The existing plant water supply system(s) will be used to supply the necessary makeup.

The existing circulating water pump motors and pump internals (two per unit) will be removed from the existing shoreline intake structure, and modifications will be made to accommodate two new saltwater cooling pumps. The saltwater cooling pumps will be used to provide the necessary cooling water to the service water heat exchangers and component coolers.

Access/maintenance roads will be provided. The existing fire loop will be extended to the cooling tower area.

The electrical load for this option is currently estimated to be 90 MVA per unit. Due to the sizes and locations of the electrical loads, a dedicated new power distribution system taken from the high voltage switchyard is required. The design basis will be to have two 100%-capacity power supplies feed these loads. Two three-winding, 90 MVA transformers will feed each unit. The four circulating water pumps will be fed from each of the secondary windings. The "new" electrical distribution voltage levels will be 12 kV (in line with the existing MV at DCPP) for the large circulating water motors (11.5 kV), 480 V for the cooling fans and other tower auxiliary equipment, and 120 V AC for smaller loads. There will be dedicated 125 V DC batteries (along with an associated battery charger) for critical UPS loads and control power for distribution equipment. The batteries will be sized for a 2-hour duration, and the charger will be sized to recharge them in 8 hours.

New loads located in the existing plant intake area (e.g., the salt water supply pumps, two per unit) will be fed from the existing power distribution system. The existing power capacity will have adequate spare capacity because the existing feed to the circulating water pumps (two at 13,000 hp per unit) will be removed since the new cooling water pumps will be fed from the new distribution system.

Wet Natural Draft Cooling Tower

Reference Drawings:

- 25762-110-E1K-0000-00003 One Line Diagram: DCPP Circulating Water System Natural Draft Cooling (Wet)
- 25762-110-M5K-WL-00003 PFD Circulating Water System – Natural Draft Cooling (Wet)
- 25762-110-M5K-YA-00001/1 Water Balance Diagram
- 25762-110-M5K-YA-00001/2 Water Balance Diagram
- 25762-110-M6K-WL-00003 P&ID Circulating Water System – Natural Draft Cooling (Wet)
- 25762-110-M6K-WO-00001 P&ID Desal Supply & Brine Return
- 25762-110-M6K-WR-00001 P&ID Grey Water Supply
- 25762-110-P1K-WL -00040 Circulating Water System – Wet Natural Draft Cooling Tower – General Arrangement

Cooling towers for Unit 1 and Unit 2 will be located northeast of the Unit 1 turbine building and east of the existing SLO-2 Archeological Site. The existing portion of the mountain at this location will be lowered to an elevation of 115 feet to accommodate the towers. Two metal hyperbolic natural draft towers will be required to support each unit, resulting in a total of four towers. The towers will be capable of maintaining a design “cold” circulating water temperature of 80°F, which is significantly higher than the once-through system “cold” temperature of 65°F. The increase in cold water temperature will result in higher condenser backpressures, which will result in a net decrease in power. In addition the higher cooling water temperature will require replacing the service water heat exchangers and component cooler to meet the heat exchanger hot-side outlet temperature of 95°F. Although physically larger, the new heat exchangers will fit in the current location. Modification of piping local to the heat exchangers is required.

Two circulating water pumphouse structures will be provided, one for each unit. The Unit 1 pumphouse will be located northeast of the turbine building and south of the SLO-2 Archeological Site. The Unit 2 pumphouse will be located west of the Unit 1 turbine building. Two 12-foot-in-diameter supply pipes per unit will be routed from the cooling tower structures to the west side of the turbine building. The existing condenser inlet concrete conduits will be modified to connect to these pipes. The condenser outlet concrete conduit will be modified, Gates 1A and 2A will be removed, and the conduit will be isolated from the plant outfall. Two 12-foot-in-diameter pipes per unit will be connected to the modified condenser outlet concrete conduit and routed to the associated unit's circulating water pumphouse structure. Four 25%-capacity circulating water pumps with common suction and discharge headers will be provided per unit. From each unit's pumphouse, two 12-foot-in-diameter pipes will be routed back to the cooling tower inlets.

The closed cycle cooling system requires an increase in the overall design pressure of the circulating water system. The tube side of the main condensers will be modified to increase the tube-side pressure design from 25 psig to 50 psig.

When a wet tower is used, significant quantities of water are lost from the system in the form of evaporation and blowdown. As indicated in the water balance (25762-110-M5K-YA-0001), up to 16,550 gpm could be consumed. To accommodate this requirement, a desalination facility designed to provide 100% of the needed water will be installed at the site. The desalination facility will be located north of the turbine building and north of the existing SLO-2 Archeological Site. Desalination seawater supply pumps will be installed in the existing plant shoreline intake structure. Piping will be routed from the intake structure around the SLO-2 Archeological Site to the desalination facility. A second line will be routed from the desalination facility back to the plant outfall to discharge the brine produced by the desalination process. The "good" water produced by the desalination facility will be pumped to an approximately 5-million-gallon storage pond located by the cooling towers. Tower blowdown will be accomplished via a connection from the circulating water piping supply line to the condensers routed to the plant outfall. The existing circulating water pump motors and pump internals (two per unit) will be removed from the existing shoreline intake structure, and modifications will be made to accommodate two new desalination saltwater supply pumps.

When it is available, grey water will be used to meet or supplement the closed cooling cycle water demand. Up to 2,800 gpm of grey water can be obtained from the following sources that are within a 20-mile radius of DCPP:

- San Luis Obispo WWTP
- Cayucos WWTP

It will be necessary to pretreat the grey water before it can be used in the cooling circuit. The equipment required to do this will be located adjacent to the desalination facility.

Access/maintenance roads will be provided to service the cooling towers and desalination facility. The existing fire loop will be extended to service these areas.

The electrical load for this option is currently estimated to be 70 MVA per unit. Due to the sizes and locations of the electrical loads, a dedicated new power distribution system taken from the high voltage switchyard is required. The design basis will be to have two 100%-capacity power supplies feed these loads. Two three-winding, 70 MVA transformers will feed each unit. The four circulating water pumps will be fed from each of the secondary windings. The "new" electrical distribution voltage levels will be 12 kV (in line with the existing MV at DCPP) for the large circulating water motors (11.5 kV), 480 V for the desalination loads and other tower auxiliary equipment, and 120 V AC for smaller loads. There will be dedicated 125 V DC batteries (along with an associated battery charger) for critical UPS loads and control power for distribution equipment. The batteries will be sized for 2-hour duration, and the charger will be sized to recharge them in 8 hours.

New loads located in the existing plant intake area (e.g., the desalination supply pumps, which are relatively large) will be fed from the existing power distribution system. The existing power capacity will have adequate spare capacity because the existing feed to the circulating water pumps (two at 13,000 hp per unit) will be removed since the new cooling water pumps will be fed from the new distribution system.

Wet Mechanical Draft Cooling Tower

Reference Drawings:

- 25762-110-E1K-0000-00004 One Line Diagram: DCPP Circulating Water System Mechanical Draft Cooling (Wet)
- 25762-110-ERK-WL-00004 Circulating Water System Wet Mechanical Draft Cooling Tower Preliminary Raceway Layout
- 25762-110-M5K-WL-00004 PFD Circulating Water System – Mechanical Draft Cooling (Wet)
- 25762-110-M5K-YA-00001/1 Water Balance Diagram
- 25762-110-M5K-YA-00001/2 Water Balance Diagram
- 25762-110-M6K-WL-00004 P&ID Circulating Water System – Mechanical Draft Cooling (Wet)
- 25762-110-M6K-WO-00001 P&ID Desal Supply & Brine Return
- 25762-110-M6K-WR-00001 P&ID Grey Water Supply
- 25762-110-P1K-WL-00050 Circulating Water System – Wet Mechanical Draft Cooling Tower – General Arrangement

Cooling towers for Unit 1 and Unit 2 will be located northeast of the Unit 1 turbine building and east of the existing SLO-2 Archeological Site. The existing portion of the mountain at this location will be lowered to an elevation of 115 feet to accommodate the towers. Two concrete/fiberglass circular mechanical draft towers will be required to support each unit, resulting in a total of four towers. The towers will be capable of maintaining a design “cold” circulating water temperature of 77°F, which is significantly higher than the once-through system “cold’ temperature of 65°F. The increase in cold water temperature will result in higher condenser backpressures, which will result in a net decrease in power. In addition the higher cooling water temperature will require replacing the service water heat exchangers and component cooler to meet the heat exchanger hot-side outlet temperature of 95°F. Although physically larger, the new heat exchangers will fit in the current location. Modification of piping local to the heat exchangers is required.

Two circulating water pumphouse structures will be provided, one for each unit. The Unit 1 pumphouse will be located northeast of the turbine building and south of the SLO-2 Archeological Site. The Unit 2 pumphouse will be located west of the Unit 1 turbine building. Two 12-foot-in-diameter supply pipes per unit will be routed from the cooling tower structures to the west side of the turbine building. The existing condenser inlet concrete conduits will be modified to connect to these pipes. The condenser outlet concrete conduit will be modified, Gates 1A and 2A will be removed, and the conduit will be isolated from the plant outfall. Two 12-foot-in-diameter pipes per unit will be connected to the modified condenser outlet concrete conduit and routed to the associated unit's circulating water pumphouse structure. Four 25%-capacity circulating water pumps with common suction and discharge headers will be provided per unit. From each unit's pumphouse, two 12-foot-in-diameter pipes will be routed back to the cooling tower inlets.

The closed cycle cooling system requires an increase in the overall design pressure of the circulating water system. Modifications to the tube side of the main condensers will be required to increase the tube-side pressure design from 25 psig to 50 psig.

When a wet tower is used, significant quantities of water are lost from the system in the form of evaporation and blowdown. As indicated in the water balance (25762-110-M5K-YA-0001), up to 16,550 gpm could be consumed. To accommodate this requirement, a desalination facility designed to provide 100% of the needed water will be installed at the site. The desalination facility will be located north of the turbine building and north of the existing SLO-2 Archeological Site. Desalination seawater supply pumps will be installed in the existing plant shoreline intake structure. Piping will be routed from the intake structure around the SLO-2 Archeological Site to the desalination facility. A second line will be routed from the desalination facility back to the plant outfall to discharge the brine produced by the desalination process. The "good" water produced from the desalination facility will be pumped to an approximately 5-million-gallon storage pond located by the cooling towers. Tower blowdown will be accomplished via a connection from the circulating water piping supply line to the condensers routed to the plant outfall. The existing circulating water pump motors and pump internals (two per unit) will be removed from the existing shoreline intake structure, and modifications will be made to accommodate two new desalination saltwater supply pumps.

When it is available, grey water will be used to meet or supplement the closed cooling cycle water demand. Up to 2,800 gpm of grey water can be obtained from the following sources that are within a 20-mile radius of DCPP:

- San Luis Obispo WWTP
- Cayucos WWTP

It will be necessary to pretreat the grey water before it can be used in the cooling circuit. The equipment required to do this will be located adjacent to the desalination facility.

Access/maintenance roads will be provided to service the cooling towers and desalination facility. The existing fire loop will be extended to service these areas.

The electrical load for this option is currently estimated to be 80 MVA per unit. Due to the sizes and locations of the electrical loads, a dedicated new power distribution system taken from the high voltage switchyard is required. The design basis will be to have two 100%-capacity power supplies feed these loads. Two three-winding, 80 MVA transformers will feed each unit. The four circulating water pumps will be fed from each of the secondary windings. The “new” electrical distribution voltage levels will be 12 kV (in line with the existing MV at DCPP) for the large circulating water motors (11.5 kV); 480 V for the desalination loads, cooling tower fans, and other tower auxiliary equipment; and 120 V AC for smaller loads. There will be dedicated 125 V DC batteries (along with an associated battery charger) for critical UPS loads and control power for distribution equipment. The batteries will be sized for a 2-hour duration, and the charger will be sized to recharge them in 8 hours.

New loads located in the existing plant intake area (e.g., the desalination supply pumps, which are relatively large) will be fed from the existing power distribution system. The existing power capacity will have adequate spare capacity because the existing feed to the circulating water pumps (two at 13,000 hp per unit) will be removed since the new cooling water pumps will be fed from the new distribution system.

Hybrid Cooling Tower

Reference Drawings:

- 25762-110-E1K-0000-00005 One Line Diagram: DCPP Circulating Water System Hybrid Cooling Option
- 25762-110-M5K-WL-0005 PFD Circulating Water System – Hybrid Cooling (Wet/Dry)
- 25762-110-M5K-YA-00001/1 Water Balance Diagram
- 25762-110-M5K-YA-00001/2 Water Balance Diagram
- 25762-110-M6K-WL-00005 P&ID Circulating Water System – Hybrid Cooling Option
- 25762-110-M6K-WO-00001 P&ID Desal Supply & Brine Return
- 25762-110-M6K-WR-00001 P&ID Grey Water Supply
- 25762-110-P1K-WL-00030 Circulating Water System – Hybrid Draft Cooling Tower – General Arrangement

Cooling towers for Unit 1 and Unit 2 will be located northeast of the Unit 1 turbine building and east of the existing SLO-2 Archeological Site. The existing portion of the mountain at this location will be lowered to an elevation of 115 feet to accommodate the towers. Two concrete circular hybrid mechanical draft towers will be required to support each unit, resulting in a total of four towers. The towers will be capable of maintaining a design “cold” circulating water temperature of 77°F, which is significantly higher than the once-through system “cold’ temperature of 65°F. The increase in cold water temperature will result in higher condenser backpressures, which will result in a net decrease in power. In addition, the higher cooling water temperature will require replacing the service water heat exchangers and component cooler to meet the heat exchanger hot-side outlet temperature of 95°F. Although physically larger, the new heat exchangers will fit in the current location. Modification of piping local to the heat exchangers is required.

Two circulating water pumphouse structures will be provided, one for each unit. The Unit 1 pumphouse will be located northeast of the turbine building and south of the SLO-2 Archeological Site. The Unit 2 pumphouse will be located west of the Unit 1 turbine building. Two 12-foot-in-diameter supply pipes per unit will be routed from the cooling tower structures to the west side of the turbine building. The existing condenser inlet concrete conduits will be modified to connect to these pipes. The condenser outlet concrete conduit will be modified, Gates 1A and 2A will be removed, and the conduit will be isolated from the plant outfall. Two 12-foot-in-diameter pipes per unit will be connected to the modified condenser outlet concrete conduit and routed to the associated unit's circulating water pumphouse structure. Four 25%-capacity circulating water pumps with common suction and discharge headers will be provided per unit. From each unit's pumphouse, two 12-foot-in-diameter pipes will be routed back to the cooling tower inlets.

The closed cycle cooling system requires an increase in the overall design pressure of the circulating water system. Modifications to the tube side of the main condensers will be required to increase the tube-side pressure design from 25 psig to 50 psig.

When a wet tower is used, significant quantities of water are lost from the system in the form of evaporation and blowdown. As indicated in the water balance (25762-110-M5K-YA-0001), up to 16,550 gpm could be consumed. To accommodate this requirement, a desalination facility designed to provide 100% of the needed water will be installed at the site. The desalination facility will be located north of the turbine building and north of the existing SLO-2 Archeological Site. Desalination seawater supply pumps will be installed in the existing plant shoreline intake structure. Piping will be routed from the intake structure around the SLO-2 Archeological Site to the desalination facility. A second line will be routed from the desalination facility back to the plant outfall to discharge the brine produced by the desalination process. The "good" water produced from the desalination facility will be pumped to an approximately 5-million-gallon storage pond located by the cooling towers. Tower blowdown for the will be accomplished via a connection from the circulating water piping supply line to the condensers routed to the plant outfall. The existing circulating water pump motors and pump internals (two per unit) will be removed from the existing shoreline intake structure, and modifications will be made to accommodate two new desalination saltwater supply pumps.

When it is available, grey water will be used to meet or supplement the closed cooling cycle water demand. Up to 2,800 gpm of grey water can be obtained from the following sources that are within a 20-mile radius of DCPP:

- San Luis Obispo WWTP
- Cayucos WWTP

It will be necessary to pretreat the grey water before it can be used in the cooling circuit. The equipment required to do this will be located adjacent to the desalination facility.

Access/maintenance roads will be provided to service the cooling towers and desalination facility. The existing fire loop will be extended to service these areas.

The electrical load for this option is currently estimated to be 100 MVA per unit. Due to the sizes and locations of the electrical loads, a dedicated new power distribution system taken from the high voltage switchyard is required. The design basis will be to have two 100%-capacity power supplies feed these loads. Two three-winding 100 MVA transformers will feed each unit. The four circulating water pumps will be fed from each of the secondary windings. The “new” electrical distribution voltage levels will be 12 kV (in line with the existing MV at DCPP) for the large circulating water motors (11.5 kV); 480 V for the desalination loads, cooling tower fans, and other tower auxiliary equipment; and 120 V AC for smaller loads. There will be dedicated 125 V DC batteries (along with an associated battery charger) for critical UPS loads and control power for distribution equipment. The batteries will be sized for a 2-hour duration, and the charger will be sized to recharge them in 8 hours.

New loads located in the existing plant intake area (e.g. the desalination supply pumps, which are relatively large) will be fed from the existing power distribution system. The existing power capacity will have adequate spare capacity because the existing feed to the circulating water pumps (two at 13,000 hp per unit) will be removed since the new cooling water pumps will be fed from the new distribution system.

Inshore Mechanical (Active) Intake Fine Mesh Screening Systems

Reference Drawings:

- 25762-110-M6K-WT-00001 P&ID Traveling Screen Wash and Fish Return System
- 25762-110-P1K-WL-00070 Circulating Water System – Fine Mesh Screen House – General Arrangement

Existing Unit 1 once-through traveling water screens 1-1 through 1-6 and Unit 2 once-through traveling water screen 2-1 through 2-6 will be replaced with new larger dual-flow screens. These screens service the unit’s circulating water pumps. Existing once-through traveling water screens 1-7 and 2-7 will not be replaced. These screens are dedicated to the safety-related auxiliary saltwater cooling system. This modification will reduce the average velocity across the screens to approximately 1.0 fps.

The new traveling water screens will incorporate a fish/larvae removal system. Separate systems will be provided for each unit. The fish/larvae will be returned to the sea north of the intake structure. The new screens with fish/larvae return systems will required more water than currently available from the existing screen wash system. Additional pumps, two per unit, will be provided to supplement the existing screen wash system. The pumps will be located in the circulating water pump bays to minimize the effects on existing screens 1-7 and 2-7.

For the system to work properly, a racking system is required to remove debris that builds up on the intake racks located in front of the traveling screens. The raking configuration previously designed for the intake structure cannot be installed or operated due to security requirements. A redesigned system will be developed that will address security concerns.

The overall additional electrical load for this modification is relatively minimal. The existing power distribution system has the required capacity for the incremental load and will be modified as required. The existing 480 V intake load center switchgear will feed the loads to the extent possible. Feeders will be used to swap the existing screen load with the new screen load, and new feeders will be added as required. This option also requires additional new 200 hp screen wash pumps per load center lineup; these will be fed from the existing load center by making appropriate modification as needed.

Offshore Modular Wedge Wire

Reference Drawings:

- 25762-110-P1K-0000-00060 Circulating Water System – Wedge Wire Screens – General Arrangement

This modification requires (1) enclosing the intake cove with a breakwater to form a shoreline basin that prevents direct seawater inflow into the existing intake structure and (2) introducing new conduit that goes underneath and beyond the breakwater to convey seawater filtered by wedge wire screens back to the intake. The conduit can take the form of either a tunnel with laterals, or several pipes. The choice of tunnel or piping will be based on the total installed cost and the impact on the environment. For the tunnel option, the tunnel would be 30 feet in diameter and extend approximately 1,000 feet into the ocean, where it would connect to five or six laterals with wedge wire screens along the laterals. For the piping option, there would be ten 9-foot-in-diameter pipes to which the wedge wire screens would be directly connected. The pipes would extend approximately 450 feet into the ocean. The difference in length is a result of the final configuration of the breakwater between the tunnel and piping options.

The offshore location of the wedge wire screens depends on local bathymetry and biological sensitivity and the decision to use a tunnel or piping to connect the screens and the intake. Additionally, the choice of slot size between 2 mm and 6 mm is key to the number of screens needed and also affects their locations. If a 2 mm slot size is used, then to achieve the required flow of approximately 1.8 million gpm at a velocity less than 0.5 feet/second, forty-eight 8-foot wedge wire screens would be required; if a 6 mm slot size is used, thirty 8-foot wedge wire screens would be required.

Two removable emergency stop log gates will be installed in the breakwater to ensure that, a second water supply is available for the auxiliary salt water system.

TECHNOLOGY OVERSIGHTS—SONGS

This section provides a summary description of progress on technology concepts being pursued in Phase 2 of the State PTC-Policy Nuclear Fueled Power Plant (NFPP) Special Studies for SONGS. Intent of Phase 2 of the Special Studies is inform the SCRCB on plant specific feasibility/efficacy of the technologies under evaluation to reduced impingement and entrainment associated with operation of existing plant once-through cooling systems. The Phase 2 technologies described are:

- Conversion to Closed Cycle Cooling Water Systems (Cooling Towers); five different types of cooling towers were considered:
  - Dry Natural Draft Cooling Tower
  - Dry Mechanical Draft Cooling Tower
  - Wet Natural Draft Cooling Tower
  - Wet Mechanical Draft Cooling Tower
  - Hybrid Cooling Tower (combination of the dry and wet technologies)
- Inshore Mechanical (Active) Intake Fine Mesh Screening Systems
- Offshore Modular Wedge Wire

Closed Cycle Cooling Systems

The options considered replace only the non-safety related portions of the existing once-through cooling system. The portion of the existing system identified as “salt water cooling” remains a once-through cooling system. The general locations of the cooling towers and primary circulating piping are essentially identical for all of these closed cycle cooling systems. The primary differences are related to the specific tower designs and the required supporting systems.

Dry Natural Draft Cooling Tower

Reference Drawings:

• 25761-110-E1K-0000-00001	One Line Diagram: SONGS Circulating Water System Natural Draft Cooling (Dry)
• 25761-110-M5K-WL-00001	PFD Circulating Water System – Natural Draft Cooling (Dry)
• 25761-110-M5K-YA-00001/1	Water Balance Diagram
• 25761-110-M5K-YA-00001/2	Water Balance Diagram
• 25761-110-M6K-WL-00001	P&ID Circulating Water System – Natural Draft Cooling (Dry)
• 25761-110-P1K-WL-00010	Circulating Water System – Dry Natural Draft Cooling Tower – General Arrangement

Cooling towers for Unit 2 and Unit 3 will be located on the mesa northeast of the power block and east of I-5 (San Diego Freeway) and the Old Pacific Highway. The mesa elevation is approximately 100 feet, while the existing power block is at an approximate elevation of 30 feet. Three metal hyperbolic natural draft towers will be required to support each unit, resulting in a total of six towers. The towers will be capable of maintaining a design “cold” circulating water temperature of 99°F, which is significantly higher than the once-through system “cold” design temperature of 64°F. The increase in cold water temperature will result in higher condenser backpressures, resulting in a net decrease in power. In addition, a water temperature of 99°F is too high to support the equipment supported by the turbine cooling water (TCW) heat exchangers. The TCW heat exchangers will be placed on an independent once-through cooling system requiring a flow of approximately 15,000 gpm per heat exchanger per unit to be withdrawn from the existing seawater intake structure.

One new circulating water pumphouse structure will be provided to house the new circulating water pumps for both Units 2 and 3. Two 12-foot-in-diameter supply pipes per unit will be required. This piping will be routed from the mesa area under I-5, the railroad tracks, and the Old Pacific Highway, with the Unit 2 supply passing south of the new pumphouse structure and the Unit 3 supply passing north of the new pumphouse structure. The supply piping will turn south after passing the new pumphouse structure and will run along the shoreline at or below sea level. Part of the existing plant discharge conduit will be modified and isolated from the plant discharge structure. The supply piping will be connected to this modified conduit, which will also be isolated from the condenser outlet conduit and connected to a new supply conduit formed by walling off the existing circulating pump supply area from the remainder of the existing intake structure. The two figures on the following page illustrate how the piping to and from the condenser will be connected to the new circulating water system piping. These figures apply to all of the closed cooling water options. The existing circulating water pumps (four per unit) will be removed, and the new supply conduit will be connected to the existing turbine building condenser inlet conduit. The existing condenser outlet conduit will be isolated as it turns south in Unit 2 (north in Unit 3), and a new conduit will be added in each unit that routes the condenser outlet to the west. Two new 12-foot-in-diameter pipes for each unit will then be added and routed north along the coastline until they can be turned north to the new circulating water pumphouse structure. Four new circulating water pumps per unit will be furnished in the pumphouse structure. Two new 12-foot-in-diameter return pipes per unit will be routed under the Old Pacific Highway, the railroad tracks, and I-5 back to the inlets of the new cooling towers.

The closed cycle cooling system requires an increase in the overall design pressure of the circulating water system. The tube side of the main condensers will be modified to increase the tube-side pressure design from 50 psig to 70 psig.

Because the dry system does not evaporate water, makeup is only required to fill the system and make up for leakage. The existing plant water supply system(s) will be used to supply the necessary makeup.

Two new saltwater cooling pumps per unit will be required to provide the necessary cooling water for the TCW heat exchangers. The new saltwater cooling pumps will be located in the existing intake structure.

Access/maintenance roads will be provided as needed to support the new equipment. The existing mesa fire loop will be extended to provide the fire protection required for the new equipment on the mesa. The existing power block fire system will be extended to provide the fire protection for the new circulating water pumphouse structure.

The electrical load for this option is currently estimated to be 30 MVA per unit. Due to the sizes and locations of the electrical loads, a dedicated new power distribution system taken from the high voltage switchyard is required. The design basis will be to have two 100%-capacity power supplies feed these loads. Two three-winding, 30 MVA transformers will feed each unit. The four circulating water pumps will be fed from each of the secondary windings. The “new” electrical distribution voltage levels will be 13.8 kV (a new voltage level for SONGS) for the large circulating water motors (13.2 kV), 480 V for the cooling tower auxiliary equipment, and 120 V AC for smaller loads. The new 13.8 kV voltage level is required because of the long power distribution distances (6.9 kV is the current highest voltage level at SONGS). There will be dedicated 125 V DC batteries (along with an associated battery charger) for critical UPS loads and control power for distribution equipment. The batteries will be sized for a 2-hour duration, and the charger will be sized to recharge them in 8 hours.

New loads located in the existing plant intake area (e.g., the saltwater cooling supply pumps, two per unit) will be fed from the existing power distribution system. The existing power capacity will have adequate spare capacity because the existing feed to the circulating water pumps (four at 2,500 hp per unit) will be removed since the new circulating water pumps will be fed from the new distribution system.

Dry Mechanical Draft Cooling Tower

Reference Drawings:

- 25761-110-E1K-0000-00002 One Line Diagram: SONGS Circulating Water System Natural Draft Cooling (Dry)
- 25761-110-E1K-0000-00002/1 Unit 2 One Line Diagram 4160V Switchgear Bus 2A03
- 25761-110-E1K-0000-00002/2 Unit 2 One Line Diagram 4160V Switchgear Bus 2A07
- 25761-110-M5K-WL-00002 PFD Circulating Water System – Mechanical Draft Cooling (Dry)
- 25761-110-M5K-YA-00001/1 Water Balance Diagram
- 25761-110-M5K-YA-00001/2 Water Balance Diagram
- 25761-110-M6K-WL-00002 P&ID Circulating Water System – Mechanical Draft Cooling (Dry)
- 25761-110-P1K-WL-00020 Circulating Water System – Dry Mechanical Draft Cooling Tower – General Arrangement

Cooling towers for Unit 2 and Unit 3 will be located on the mesa northeast of the power block and east of I-5 (San Diego Freeway) and the Old Pacific Highway. The mesa elevation is approximately 100 feet, while the existing power block is at an approximate elevation of 30 feet. One concrete/fiberglass rectangular mechanical draft tower (approximately 760 feet x 1,590 feet) will be required to support each unit. The towers will be capable of maintaining a design “cold” circulating water temperature of 99°F, which is significantly higher than the once-through system “cold” design temperature of 64°F. The increase in cold water temperature will result in higher condenser backpressures, resulting in a net decrease in power. In addition, a water temperature of 99°F is too high to support the equipment supported by the TCW heat exchangers. The TCW heat exchangers will be placed on an independent once-through cooling system requiring a flow of approximately 15,000 gpm per heat exchanger per unit to be withdrawn from the existing seawater intake structure.

One new circulating water pumphouse structure will be provided to house the new circulating water pumps for both Units 2 and 3. Two 12-foot-in-diameter supply pipes per unit will be required. This piping will be routed from the mesa area under I-5, the railroad tracks, and the Old Pacific Highway, with the Unit 2 supply passing south of the new pumphouse structure and the Unit 3 supply passing north of the new pumphouse structure. The supply piping will turn south after passing the new pumphouse structure and will run along the shoreline at or below sea level. Part of the existing plant discharge conduit will be modified and isolated from the plant discharge structure. The supply piping will be connected to this modified conduit, which will also be isolated from the condenser outlet conduit and connected to a new supply conduit formed by walling off the existing circulating pump supply area from the remainder of the existing intake structure. The existing circulating water pumps (four per unit) will be removed, and the new supply conduit will be connected to the existing turbine building condenser inlet conduit. The existing condenser outlet conduit will be isolated as it turns south in Unit 2 (north in Unit 3), and a new conduit will be added in each unit that routes the condenser outlet to the west. Two new 12-foot-in-diameter pipes for each unit will then be added and routed north along the coastline until they can be turned north to the new circulating water pumphouse structure. Four new circulating water pumps per unit will be furnished in the pumphouse structure. Two new 12-foot-in-diameter return pipes per unit will be routed under the Old Pacific Highway, the railroad tracks, and I-5 back to the inlets of the new cooling towers.

The closed cycle cooling system requires an increase in the overall design pressure of the circulating water system. The tube side of the main condensers will be modified to increase the tube-side pressure design from 50 psig to 70 psig.

Because the dry system does not evaporate water, makeup is only required to fill the system and make up for leakage. Existing plant water supply system(s) will be used to supply the necessary makeup.

Two new saltwater cooling pumps per unit will be required to provide the necessary cooling water for the TCW heat exchangers. The new saltwater cooling pumps will be located in the existing intake structure.

Access/maintenance roads will be provided as needed to support the new equipment. The existing mesa fire loop will be extended to provide the fire protection required for the new equipment on the mesa. The existing power block fire system will be extended to provide the fire protection for the new circulating water pumphouse structure.

The electrical load for this option is currently estimated to be 90 MVA per unit. Due to the sizes and locations of the electrical loads, a dedicated new power distribution system taken from the high voltage switchyard is required. The design basis will be to have two 100%-capacity power supplies feed these loads. Two three-winding, 90 MVA transformers will feed each unit. The four circulating water pumps will be fed from each of the secondary windings. The “new” electrical distribution voltage levels will be 13.8 kV (a new voltage level for SONGS) for the large circulating water motors (13.2 kV), 480 V for the cooling tower fans and other tower auxiliary equipment, and 120 V AC for smaller loads. The new 13.8 kV voltage level is required because of the long power distribution distances (6.9 kV is the current highest voltage level at SONGS). There will be dedicated 125 V DC batteries (along with an associated battery charger) for critical UPS loads and control power for distribution equipment. The batteries will be sized for a 2- hour duration, and the charger will be sized to recharge them in 8 hours.

New loads located in the existing plant intake area (e.g., the saltwater cooling supply pumps, two per unit) will be fed from the existing power distribution system. The existing power capacity will have adequate spare capacity because the existing feed to the circulating water pumps (four at 2,500 hp per unit) will be removed since the new circulating water pumps will be fed from the new distribution system.

Wet Natural Draft Cooling Tower

Reference Drawings:

- 25761-110-E1K-0000-00003 — One Line Diagram: SONGS Circulating Water System Natural Draft Cooling (Wet)
- 25761-110-E1K-0000-00003/1 — Unit 2 One Line Diagram 4160V Switchgear Bus 2A03
- 25761-110-E1K-0000-00003/2 — Unit 2 One Line Diagram 4160V Switchgear Bus 2A07
- 25761-110-M5K-WL-00003 — PFD Circulating Water System – Natural Draft Cooling (Wet)
- 25761-110-M5K-YA-00001/1 — Water Balance Diagram
- 25761-110-M5K-YA-00001/2 — Water Balance Diagram
- 25761-110-M6K-WL-00003 — P&ID Circulating Water System – Natural Draft Cooling (Wet)
- 25761-110-M6K-WO-00001 — P&ID Desal Supply & Brine Return
- 25761-110-M6K-WR-00001 — P&ID Grey Water Supply
- 25761-110-P1K-WL -00040 — Circulating Water System – Wet Natural Draft Cooling Tower – General Arrangement

Cooling towers for Unit 2 and Unit 3 will be located on the mesa northeast of the power block and east of I-5 (San Diego Freeway) and the Old Pacific Highway. The mesa elevation is approximately 100 feet, while the existing power block is at an approximate elevation of 30 feet. Two metal hyperbolic natural draft towers will be required to support each unit, resulting in a total of four towers. The towers will be capable of maintaining a design “cold” circulating water temperature of 82°F, which is significantly higher than the once-through system “cold” design temperature of 64°F. The increase in cold water temperature will result in higher condenser backpressures, resulting in a net decrease in power. In addition, the higher cooling water temperature will require replacing the TCW heat exchangers to meet the heat exchanger hot-side outlet temperature of 95°F. Although physically larger, the new heat exchangers will fit in the current location. Modification of piping local to the heat exchangers is required.

One new circulating water pumphouse structure will be provided to house the new circulating water pumps for both Units 2 and 3. Two 12-foot-in-diameter supply pipes per unit will be required. This piping will be routed from the mesa area under I-5, the railroad tracks, and the Old Pacific Highway, with the Unit 2 supply passing south of the new pumphouse structure and the Unit 3 supply passing north of the new pumphouse structure. The supply piping will turn south after passing the new pumphouse structure and will run along the shoreline at or below sea level. Part of the existing plant discharge conduit will be modified and isolated from the plant discharge structure. The supply piping will be connected to this modified conduit, which will also be isolated from the condenser outlet conduit and connected to a new supply conduit formed by walling off the existing circulating pump supply area from the remainder of the existing intake structure. The existing circulating water pumps (four per unit) will be removed, and the new supply conduit will be connected to the existing turbine building condenser inlet conduit. The existing condenser outlet conduit will be isolated as it turns south in Unit 2 (north in Unit 3), and a new conduit will be added in each unit that routes the condenser outlet to the west. Two new 12-foot-in-diameter pipes for each unit will then be added and routed north along the coastline until they can be turned north to the new circulating water pumphouse structure. Four new circulating water pumps per unit will be furnished in the pumphouse structure. Two new 12-foot-in-diameter return pipes per unit will be routed under the Old Pacific Highway, the railroad tracks, and I-5 back to the inlets of the new cooling towers.

The closed cycle cooling system requires an increase in the overall design pressure of the circulating water system. The tube side of the main condensers will be modified to increase the tube-side pressure design from 50 psig to 70 psig.

When a wet tower is used, significant quantities of water are lost from the system in the form of evaporation and blowdown. As indicated in the water balance (25761-110-M5K-YA-0001), up to 14,650 gpm could be consumed. To accommodate this requirement, a desalination facility designed to provide 100% of the needed water will be installed at the site. The desalination facility will be located on the mesa along with the cooling towers. Desalination seawater supply pumps will be installed in the existing plant intake structure. Piping will be routed from the intake structure parallel to the circulating water piping (parallel to the shoreline) and under the Old Pacific Highway and I-5 to the desalination facility. A second line will be routed from the desalination facility back to the plant outfall to discharge the brine produced by the desalination process. The “good” water produced by the desalination facility will be pumped to an approximately 5-million-gallon storage pond located by the cooling towers. Tower blowdown will be accomplished via a connection from the circulating water piping supply line to the condensers routed to the plant outfall.

When it is available, grey water will be used to meet or supplement the closed cooling cycle water demand. Up to 25,400 gpm in the summer and 35,500 gpm in the winter of grey water can be obtained from the following sources that are within a 20-mile radius of SONGS:

- Oceanside Ocean Outfall
- Aliso Creek Ocean Outfall
- San Juan Creek Ocean Outfall

It will be necessary to pretreat the grey water before it can be used in the cooling circuit. The equipment required to do this will be located adjacent to the desalination facility.

Access/maintenance roads will be provided as needed to support the new equipment. The existing mesa fire loop will be extended to provide the fire protection required for the new equipment on the mesa. The existing power block fire system will be extended to provide the fire protection for the new circulating water pumphouse structure.

The electrical load for this option is currently estimated to be 70 MVA per unit. Due to the sizes and locations of the electrical loads, a dedicated new power distribution system taken from the high voltage switchyard is required. The design basis will be to have two 100%-capacity power supplies feed these loads. Two three-winding, 70 MVA transformers will feed each unit. The four circulating water pumps will be fed from each of the secondary windings. The “new” electrical distribution voltage levels will be 13.8 kV (a new voltage level for SONGS) for the large circulating water motors (13.2 kV), 480 V for the cooling tower auxiliary equipment and desalination loads, and 120 V AC for smaller loads. The new 13.8 kV voltage level is required because of the long power distribution distances (6.9 kV is the current highest voltage level at SONGS). There will be dedicated 125 V DC batteries (along with an associated battery charger) for critical UPS loads and control power for distribution equipment. The batteries will be sized for a 2-hour duration, and the charger will be sized to recharge them in 8 hours.

New loads located in the existing plant intake area (e.g., the desalination saltwater supply pumps) will be fed from the existing power distribution system. The existing power capacity will have adequate spare capacity because the existing feed to the circulating water pumps (four at 2,500 hp per unit) will be removed since the new circulating water pumps will be fed from the new distribution system.

Wet Mechanical Draft Cooling Tower

Reference Drawings:

- 25761-110-E1K-0000-00004 One Line Diagram: SONGS Circulating Water System Mechanical Draft Cooling (Wet)

- 25761-110-E1K-0000-00004/1 Unit 2 One Line Diagram 4160V Switchgear Bus 2A03
- 25761-110-E1K-0000-00004/2 Unit 2 One Line Diagram 4160V Switchgear Bus 2A07
- 25761-110-ERK-WL-00004 Circulating Water System Wet Mechanical Draft Cooling Tower Preliminary Raceway Layout
- 25761-110-M5K-WL-00004 PFD Circulating Water System – Mechanical Draft Cooling (Wet)
- 25761-110-M5K-YA-00001/1 Water Balance Diagram
- 25761-110-M5K-YA-00001/2 Water Balance Diagram
- 25761-110-M6K-WL-00004 P&ID Circulating Water System – Mechanical Draft Cooling (Wet)
- 25761-110-M6K-WO-00001 P&ID Desal Supply & Brine Return
- 25761-110-M6K-WR-00001 P&ID Grey Water Supply
- 25761-110-P1K-WL-00050 Circulating Water System – Wet Mechanical Draft Cooling Tower – General Arrangement

Cooling towers for Unit 2 and Unit 3 will be located on the mesa northeast of the power block and east of I-5 (San Diego Freeway) and the Old Pacific Highway. The mesa elevation is approximately 100 feet, while the existing power block is at an approximate elevation of 30 feet. Two, circular (380–400-foot-in-diameter) mechanical natural draft towers will be required to support each unit, resulting in a total of four towers. The towers will be capable of maintaining a design “cold” circulating water temperature of 78°F, which is significantly higher than the once-through system “cold” design temperature of 64°F. The increase in cold water temperature will result in higher condenser backpressures, resulting in a net decrease in power. In addition, the higher cooling water temperature will require replacing the TCW heat exchangers to meet the heat exchanger hot-side outlet temperature of 95°F. Although physically larger, the new heat exchangers will fit in the current location. Modification of piping local to the heat exchangers is required.

One new circulating water pump-house structure will be provided to house the new circulating water pumps for both Units 2 and 3. Two 12-foot-in-diameter supply pipes per unit will be required. This piping will be routed from the mesa area under I-5, the railroad, and the Old Pacific Highway, with the Unit 2 supply passing south of the new pumphouse structure and the Unit 3 supply passing north of the new pumphouse structure. The supply piping will turn south after passing the new pumphouse structure and will run along the shoreline at or below sea level. Part of the existing plant discharge conduit will be modified and isolated from the plant discharge structure. The supply piping will be connected to this modified conduit, which will be also be isolated from the condenser outlet conduit and connected to a new supply conduit formed by walling off the existing circulating pump supply area from the remainder of the existing intake structure. The existing circulating water pumps (four per unit) will be removed, and the new supply conduit will be connected to the existing turbine building condenser inlet conduit. The existing condenser outlet conduit will be isolated as it turns south in Unit 2 (north in

Unit 3), and a new conduit will be added in each unit that routes the condenser outlet to the west. Two new 12-foot-in-diameter pipes for each unit will then be added and routed north along the coastline until they can be turned north to the new circulating water pumphouse structure. Four new circulating water pumps per unit will be furnished in the pumphouse structure. Two new 12-foot-in-diameter return pipes per unit will be routed under the Old Pacific Highway, the railroad tracks, and I-5 back to the inlets of the new cooling towers.

The closed cycle cooling system requires an increase in the overall design pressure of the circulating water system. The tube side of the main condensers will be modified to increase the tube-side pressure design from 50 psig to 70 psig.

When a wet tower is used, significant quantities of water are lost from the system in the form of evaporation and blowdown. As indicated in the water balance (25761-110-M5K-YA-0001), up to 14,650 gpm could be consumed. To accommodate this requirement, a desalination facility designed to provide 100% of the needed water will be installed at the site. The desalination facility will be located on the mesa along with the cooling towers. Desalination seawater supply pumps will be installed in the existing plant intake structure. Piping will be routed from the intake structure parallel to the circulating water piping (parallel to the shoreline) and under the Old Pacific Highway and I-5 to the desalination facility. A second line will be routed from the desalination facility back to the plant outfall to discharge the brine produced by the desalination process. The “good” water produced from the desalination facility will be pumped to an approximately 5-million-gallon storage pond located by the cooling towers. Tower blowdown for the will be accomplished via a connection from the circulating water piping supply line to the condensers routed to the plant outfall.

When it is available, grey water will be used to meet or supplement the closed cooling cycle water demand. Up to 25,400 gpm in the summer and 35,500 gpm in the winter of grey water can be obtained from the following sources that are within a 20-mile radius of SONGS:

- Oceanside Ocean Outfall
- Aliso Creek Ocean Outfall
- San Juan Creek Ocean Outfall

It will be necessary to pretreat the grey water before it can be used in the cooling circuit. The equipment required to do this will be located adjacent to the desalination facility.

Access/maintenance roads will be provided as needed to support the new equipment. The existing mesa fire loop will be extended to provide the fire protection required for the new equipment on the mesa. The existing power block fire system will be extended to provide the fire protection for the new circulating water pumphouse structure.

The electrical load for this option is currently estimated to be 80 MVA per unit. Due to the sizes and locations of the electrical loads, a dedicated new power distribution system taken from the high voltage switchyard is required. The design basis will be to have two 100%-capacity power supplies feed these loads. Two three-winding 80 MVA transformers will feed each unit. The four circulating water pumps will be fed from each of the secondary windings. The “new” electrical distribution voltage levels will be 13.8 kV (a new voltage level for SONGS) for the large circulating water motors (13.2 kV), 480 V for the cooling tower auxiliary equipment and desalination loads, and 120 V AC for smaller loads. The new 13.8 kV voltage level is required because of the long power distribution distances (6.9 kV is the current highest voltage level at SONGS). There will be dedicated 125 V DC batteries (along with an associated battery charger) for critical UPS loads and control power for distribution equipment. The batteries will be sized for a 2-hour duration, and the charger will be sized to recharge them in 8 hours.

New loads located in the existing plant intake area (e.g., the desalination saltwater supply pumps) will be fed from the existing power distribution system. The existing power capacity will have adequate spare capacity because the existing feed to the circulating water pumps (four at 2,500 hp per unit) will be removed since the new circulating water pumps will be fed from the new distribution system.

Hybrid Cooling Tower

Reference Drawings:

- 25761-110-E1K-0000-00005 — One Line Diagram: SONGS Circulating Water System Hybrid Cooling Option
- 25761-110-E1K-0000-00005/1 — Unit 2 One Line Diagram 4160V Switchgear Bus 2A03
- 25761-110-E1K-0000-00005/2 — Unit 2 One Line Diagram 4160V Switchgear Bus 2A07
- 25761-110-M5K-WL-0005 — PFD Circulating Water System – Hybrid Cooling (Wet/Dry)
- 25761-110-M5K-YA-00001/1 — Water Balance Diagram
- 25761-110-M5K-YA-00001/2 — Water Balance Diagram
- 25761-110-M6K-WL-00005 — P&ID Circulating Water System – Hybrid Cooling Option
- 25761-110-M6K-WO-00001 — P&ID Desal Supply & Brine Return
- 25761-110-M6K-WR-00001 — P&ID Grey Water Supply
- 25761-110-P1K-WL-00030 — Circulating Water System – Hybrid Draft Cooling Tower – General Arrangement

Cooling towers for Unit 2 and Unit 3 will be located on the mesa northeast of the power block and east of I-5 (San Diego Freeway) and the Old Pacific Highway. The mesa elevation is approximately 100 feet, while the existing power block is at an approximate elevation of 30 feet. Two concrete circular hybrid cooling towers will be required to support each unit, resulting in a total of four towers. The towers will be capable of maintaining a design “cold” circulating water temperature of 78°F, which is significantly higher than the once-through system “cold” design temperature of 64°F. The increase in cold water temperature will result in higher condenser backpressures, resulting in a net decrease in power. In addition, the higher cooling water temperature will require replacing the TCW heat exchangers to meet the heat exchanger hot-side outlet temperature of 95°F. Although physically larger, the new heat exchangers will fit in the current location. Modification of piping local to the heat exchangers is required.

One new circulating water pumphouse structure will be provided to house the new circulating water pumps for both Units 2 and 3. Two 12-foot-in-diameter supply pipes per unit will be required. This piping will be routed from the mesa area under I-5, the railroad tracks, and the Old Pacific Highway, with the Unit 2 supply passing south of the new pumphouse structure and the Unit 3 supply passing north of the new pumphouse structure. The supply piping will turn south after passing the new pumphouse structure and will run along the shoreline at or below sea level. Part of the existing plant discharge conduit will be modified and isolated from the plant discharge structure. The supply piping will be connected to this modified conduit, which will also be isolated from the condenser outlet conduit and connected to a new supply conduit formed by walling off the existing circulating pump supply area from the remainder of the existing intake structure. The existing circulating water pumps (four per unit) will be removed, and the new supply conduit will be connected to the existing turbine building condenser inlet conduit. The existing condenser outlet conduit will be isolated as it turns south in Unit 2 (north in Unit 3), and a new conduit will be added in each unit that routes the condenser outlet to the west. Two new 12-foot-in-diameter pipes for each unit will then be added and routed north along the coastline until they can be turned north to the new circulating water pumphouse structure. Four new circulating water pumps per unit will be furnished in the pumphouse structure. Two new 12-foot-in-diameter return pipes per unit will be routed under the Old Pacific Highway, the railroad tracks, and I-5 back to the inlets of the new cooling towers.

The closed cycle cooling system requires an increase in the overall design pressure of the circulating water system. The tube side of the main condensers will be modified to increase the tube-side pressure design from 50 psig to 70 psig.

When a wet tower is used, significant quantities of water are lost from the system in the form of evaporation and blowdown. As indicated in the water balance (25761-110-M5K-YA-0001), up to 13,200 gpm could be consumed. To accommodate this requirement, a desalination facility designed to provide 100% of the needed water will be installed at the site. The desalination facility will be located on the mesa along with the cooling towers. Desalination seawater supply pumps will be installed in the existing plant intake structure. Piping will be routed from the intake structure parallel to the circulating water piping (parallel to the shoreline) and under the Old Pacific Highway and I-5 to the desalination facility. A second line will be routed from the desalination facility back to the plant outfall to discharge the brine produced by the desalination process. The “good” water produced from the desalination facility will be pumped to an approximately 5-million-gallon storage pond located by the cooling towers. Tower blowdown will be accomplished via a connection from the circulating water piping supply line to the condensers routed to the plant outfall.

When it is available, grey water will be used to meet or supplement the closed cooling cycle water demand. Up to 25,400 gpm in the summer and 35,500 gpm in the winter of grey water can be obtained from the following sources that are within a 20-mile radius of SONGS:

- Oceanside Ocean Outfall
- Aliso Creek Ocean Outfall
- San Juan Creek Ocean Outfall

It will be necessary to pretreat the grey water before it can be used in the cooling circuit. The equipment required to do this will be located adjacent to the desalination facility.

Access/maintenance roads will be provided as needed to support the new equipment. The existing mesa fire loop will be extended to provide the fire protection required for the new equipment on the mesa. The existing power block fire system will be extended to provide the fire protection for the new circulating water pumphouse structure.

The electrical load for this option is currently estimated to be 100 MVA per unit. Due to the sizes and locations of the electrical loads, a dedicated new power distribution system taken from the high voltage switchyard is required. The design basis will be to have two 100%-capacity power supplies feed these loads. Two three-winding, 100 MVA transformers will feed each unit. The four circulating water pumps will be fed from each of the secondary windings. The “new” electrical distribution voltage levels will be 13.8 kV (a new voltage level for SONGS) for the large circulating water motors (13.2 kV); 480 V for the desalination loads, cooling tower fans, and other tower auxiliary equipment; and 120 V AC for smaller loads. The new 13.8 kV voltage level is required because of the long power distribution distances (6.9 kV is the current highest voltage level at SONGS). There will be dedicated 125 V DC batteries (along with an associated battery charger) for critical UPS loads and control power for distribution equipment. The batteries will be sized for 2-hour duration, and the charger will be sized to recharge them in 8 hours.

New loads located in the existing plant intake area (e.g. the desalination salt water supply pumps) will be fed from the existing power distribution system. The existing power capacity will have adequate spare capacity because the existing feed to the circulating water pumps (four at 2,500 hp per unit) will be removed since the new circulating water pumps are fed from the new distribution system.

<u>Inshore Mechanical (Active) Intake Fine Mesh Screening Systems</u>

Reference Drawings:

- 25761-110-E1K-0000-00006/1 Unit 2 Electrical One Line Diagram 480V Load Center 2B07
- 25761-110-E1K-0000-00006/2 Unit 2 Electrical One Line Diagram 480V Load Center 2B12
- 25761-110-E1K-0000-00006/3 Unit 2 Electrical One Line Diagram 480V Load Center 2B14

- 25761-110-E1K-0000-00006/4 Unit 2 Electrical One Line Diagram 480V Motor Control Center
- 25761-110-M6K-WT-00001 P&ID Traveling Screen Wash and Fish Return System
- 25761-110-P1K-WL-00070 Circulating Water System – Fine Mesh Screen House – General Arrangement

Two screen houses will be provided, one for each unit. The screen houses will be built into the ocean in front of each unit, with their outer walls forming an extension to the existing sea wall.

Each screen house will include trash racks/bars and a dual raking system, 10 dual-flow traveling screens, a fish return system, screen/fish wash pumps, a gantry maintenance crane, a crane or elevator to lift the trash from the screen house operating flour to the existing plant grade, and an electric room. The traveling screens will be sized to maintain an average through-flow velocity of 0.5 feet per second.

The plant intake piping will be modified to route all intake flow through the new screen houses, which will be design to Seismic Category I and Quality Classification II requirements.

The overall additional electrical load for this modification is relatively minimal, and the existing power distribution system has the required capacity for it. A new MCC will be added for each new screen house at the new location. The power for these MCCs and the new screen wash pumps will be from existing intake load centers. The existing 480 V breaker that feeds the existing screen wash pumps will new feed the new screen wash pumps at the new locations.

<u>Offshore Modular Wedge Wire</u>

Reference Drawing:

- 25761-110-P1K-WL-00060 Circulating Water System – Wedge Wire Screens – General Arrangement

This modification requires capping the offshore velocity cap intake head and attaching a new set of manifolds with multiple arrays of wedge wire screen modules to the existing 18-foot-in-diameter suction pipe. The auxiliary intake cap will remain unchanged. The offshore locations of the wedge wire screens will depend on local bathymetry and biological sensitivity. The choice of slot sizes between 2 mm and 6 mm is key to the number and locations of the screens. If a 2 mm slot size is used, then to achieve the approximately 1.7-million-gallon two-unit flow at a velocity of less than 0.5 feet per second, forty-six 8-foot-in-diameter wedge wire screens would be required; if a 6 mm slot size is used, thirty 8-foot-in-diameter wedge wire screens would be required.

DRAWING LISTS

DCPP—Mechanical Drawings

Drawing No.	Title	Rev.
25762-110-M5K-WL-00001	PFD Circulating Water System – Natural Draft Cooling (Dry)	A
25762-110-M5K-WL-00002	PFD Circulating Water System – Mechanical Draft Cooling (Dry)	A
25762-110-M5K-WL-00003	PFD Circulating Water System – Natural Draft Cooling (Wet)	A
25762-110-M5K-WL-00004	PFD Circulating Water System – Mechanical Draft Cooling (Wet)	A
25762-110-M5K-WL-0005	PFD Circulating Water System – Hybrid Cooling (Wet/Dry)	A
25762-110-M5K-YA-00001/1	Water Balance Diagram	A
25762-110-M5K-YA-00001/2	Water Balance Diagram	A
25762-110-M6K-WL-00001	P&ID Circulating Water System – Natural Draft Cooling (Dry)	A
25762-110-M6K-WL-00002	P&ID Circulating Water System – Mechanical Draft Cooling (Dry)	A
25762-110-M6K-WL-00003	P&ID Circulating Water System – Natural Draft Cooling (Wet)	A
25762-110-M6K-WL-00004	P&ID Circulating Water System – Mechanical Draft Cooling (Wet)	A
25762-110-M6K-WL-00005	P&ID Circulating Water System – Hybrid Cooling Option	A
25762-110-M6K-WO-00001	P&ID Desal Supply & Brine Return	A
25762-110-M6K-WR-00001	P&ID Grey Water Supply	A
25762-110-M6K-WT-00001	P&ID Traveling Screen Wash and Fish Return System	A

DCPP—Plant Design Drawings

Drawing No.	Title	Rev.
25762-110-P1K-WL-00010	Circulating Water System – Dry Natural Draft Cooling Tower – General Arrangement	A
25762-110-P1K-WL-00020	Circulating Water System – Dry Mechanical Draft Cooling Tower – General Arrangement	A
25762-110-P1K-WL-00030	Circulating Water System – Hybrid Draft Cooling Tower – General Arrangement	A
25762-110-P1K-WL-00040	Circulating Water System – Wet Natural Draft Cooling Tower – General Arrangement	A
25762-110-P1K-WL-00050	Circulating Water System – Wet Mechanical Draft Cooling Tower – General Arrangement	A
25762-110-P1K-WL-00060	Circulating Water System – Wedge Wire Screens – General Arrangement	A
25762-110-P1K-WL-00070	Circulating Water System – Fine Mesh Screen House – General Arrangement	A

DCPP—Electrical Drawings

Drawing No.	Title	Rev.
25762-110-E1K-0000-00001	One Line Diagram: DCPP Circulating Water System Natural Draft Cooling (Dry)	A
25762-110-E1K-0000-00002	One Line Diagram: DCPP Circulating Water System Mechanical Draft Cooling (Dry)	A
25762-110-E1K-0000-00003	One Line Diagram: DCPP Circulating Water System Natural Draft Cooling (Wet)	A
25762-110-E1K-0000-00004	One Line Diagram: DCPP Circulating Water System Mechanical Draft Cooling (Wet)	A
25762-110-E1K-0000-00005	One Line Diagram: DCPP Circulating Water System Hybrid Cooling Option	A
25762-110-ERK-WL-00004	Circulating Water System Wet Mechanical Draft Cooling Tower Preliminary Raceway Layout	A

SONGS—Mechanical Drawings

Drawing No.	Title	Rev.
25761-110-M5K-WL-00001	PFD Circulating Water System – Natural Draft Cooling (Dry)	A
25761-110-M5K-WL-00002	PFD Circulating Water System – Mechanical Draft Cooling (Dry)	A
25761-110-M5K-WL-00003	PFD Circulating Water System – Natural Draft Cooling (Wet)	A
25761-110-M5K-WL-00004	PFD Circulating Water System – Mechanical Draft Cooling (Wet)	A
25761-110-M5K-WL-0005	PFD Circulating Water System – Hybrid Cooling (Wet/Dry)	A
25761-110-M5K-YA-00001/1	Water Balance Diagram	A
25761-110-M5K-YA-00001/2	Water Balance Diagram	A
25761-110-M6K-WL-00001	P&ID Circulating Water System – Natural Draft Cooling (Dry)	A
25761-110-M6K-WL-00002	P&ID Circulating Water System – Mechanical Draft Cooling (Dry)	A
25761-110-M6K-WL-00003	P&ID Circulating Water System – Natural Draft Cooling (Wet)	A
25761-110-M6K-WL-00004	P&ID Circulating Water System – Mechanical Draft Cooling (Wet)	A
25761-110-M6K-WL-00005	P&ID Circulating Water System – Hybrid Cooling Option	A
25761-110-M6K-WO-00001	P&ID Desal Supply & Brine Return	A
25761-110-M6K-WR-00001	P&ID Grey Water Supply	A
25761-110-M6K-WT-00001	P&ID Traveling Screen Wash and Fish Return System	A

SONGS—Plant Design Drawings

Drawing No.	Title	Rev.
25761-110-P1K-WL-00010	Circulating Water System – Dry Natural Draft Cooling Tower – General Arrangement	A
25761-110-P1K-WL-00020	Circulating Water System – Dry Mechanical Draft Cooling Tower – General Arrangement	A
25761-110-P1K-WL-00030	Circulating Water System – Hybrid Draft Cooling Tower – General Arrangement	A
25761-110-P1K-WL-00040	Circulating Water System – Wet Natural Draft Cooling Tower – General Arrangement	A
25761-110-P1K-WL-00050	Circulating Water System – Wet Mechanical Draft Cooling Tower – General Arrangement	A
25761-110-P1K-WL-00060	Circulating Water System – Wedge Wire Screens – General Arrangement	A
25761-110-P1K-WL-00070	Circulating Water System – Fine Mesh Screen House – General Arrangement	A

SONGS—Electrical Drawings

Drawing No.	Title	Rev.
25761-110-E1K-0000-00001	One Line Diagram: SONGS Circulating Water System Natural Draft Cooling (Dry)	A
25761-110-E1K-0000-00001/1	Unit 2 One Line Diagram 4160V Switchgear Bus 2A03	A
25761-110-E1K-0000-00001/2	Unit 2 One Line Diagram 4160V Switchgear Bus 2A07	A
25761-110-E1K-0000-00002	One Line Diagram: SONGS Circulating Water System Mechanical Draft Cooling (Dry)	A
25761-110-E1K-0000-00002/1	Unit 2 One Line Diagram 4160V Switchgear Bus 2A03	A
25761-110-E1K-0000-00002/2	Unit 2 One Line Diagram 4160V Switchgear Bus 2A07	A
25761-110-E1K-0000-00003	One Line Diagram: SONGS Circulating Water System Natural Draft Cooling (Wet)	A
25761-110-E1K-0000-00003/1	Unit 2 One Line Diagram 4160V Switchgear Bus 2A03	A
25761-110-E1K-0000-00003/2	Unit 2 One Line Diagram 4160V Switchgear Bus 2A07	A
25761-110-E1K-0000-00004	One Line Diagram: SONGS Circulating Water System Mechanical Draft Cooling (Wet)	A
25761-110-E1K-0000-00004/1	Unit 2 One Line Diagram 4160V Switchgear Bus 2A03	A
25761-110-E1K-0000-00004/2	Unit 2 One Line Diagram 4160V Switchgear Bus 2A07	A
25761-110-E1K-0000-00005	One Line Diagram: SONGS Circulating Water System Hybrid Cooling Option	A
25761-110-E1K-0000-00005/1	Unit 2 One Line Diagram 4160V Switchgear Bus 2A03	A
25761-110-E1K-0000-00005/2	Unit 2 One Line Diagram 4160V Switchgear Bus 2A07	A
25761-110-E1K-0000-00006/1	Unit 2 Electrical One Line Diagram 480V Load Center 2B07	A
25761-110-E1K-0000-00006/2	Unit 2 Electrical One Line Diagram 480V Load Center 2B12	A
25761-110-E1K-0000-00006/3	Unit 2 Electrical One Line Diagram 480V Load Center 2B14	A
25761-110-E1K-0000-00006/4	Unit 2 Electrical One Line Diagram 480V Motor Control Center 2BK	A
25761-110-ERK-WL-00004	Circulating Water System Wet Mechanical Draft Cooling Tower Preliminary Raceway Layout	A